Student Lecture Tour Europe 2007-2008

New Monitoring Technologies forNatural Hazards and Surface Displacements

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The focus of this student lecture tour will be on the new monitoring methods available to measure changes of the earth's surface and how these methods may be used to identify Natural Hazard risk areas as well as monitor small scale deformations. Example case studies such as La Reunion, Galapagos volcanic islands, Chichi earthquake in Taiwan and the Paris flood will be illustrated within the lecture.

Natural Hazards and large surface displacements such as volcanic eruptions, associated landslides and active seismic activity are among the most important and dangerous Natural Hazards in the world. Coal extraction, mine subsidence, oil production and urban underground works are anthropogenic activities that cause small surface displacements. The extraction of underground resources may effectively induce a small amount of subsidence at the surface which often creates disorders on structures and/or infrastructures. In the case of coalmines and oil production, it occurs during the activity and after closing. The residual subsidence may cover a longer period of time (usually less than 5 years) after the end of exploitation. The amplitude of this residual subsidence is usually much smaller compared to the total subsidence. The comparison of the different technologies detailing location, characterization and quantification of deformations are then analyzed and interpreted within a real 3D GIS in order to better explain the origin of the deformations. The next step is to identify the most effective way to monitor and measure these displacements.

A traditional monitoring method such as levelling allows tracking of the deformations of the earth's surface by measuring precise altitude along 2D transects. This method presents some disadvantages due to the long period of time needed in the field, the expensive costs created and the resolution of the method. A more modern approach such as a Synthetic Aperture Radar interferometry technique, may present a fruitful compliment to help map and quantify the deformations. The deformations, such as residual subsidence cover large surface areas (100km x 100km) depending on the coherence of the studied areas. Two other modern methods such as SAR Interferometry (DINSAR) and Persistent Scaterrers Interferometry (PSI) are used to estimate the induced deformations which are then compared to traditional methods of levelling to show generally good agreement. There is a panel of methods available today to monitor Natural Hazards and the future goals of applied scientists is to foresee, model and simulate Natural Hazards in order to reduce their risks and costs.

About the lecturer

Professor Deffontaines holds a PhD from the University of Paris VI. His thesis on 'Structural Geology and Remote Sensing' discussed in the development of a morphoneotectonic and morphostructural methodology, is based upon digital terrain model, drainage network and summit level maps. This methodology was applied to the north eastern region of France identifying nuclear waste storage sites. Deffontaines professional experience focuses around three main areas: morphoneotectonics, natural hazards and geo-engineering. Research has been done onshore and offshore and Deffontaines has participated in several expeditions in Southeast Asia as well as teach a Masters program on 'Quantitative Modelling of Sedimentary Basins' including fieldtrips in the UK and France.

Since 2004, Professor Deffontaines has held two positions at the Marne-La-Vallee University. His first position is that of a Professor of Geomorphology and Geology and his

second position is the Chairman of the Earth Material and Engineering Geology Laboratory. Deffontaines is also actively involved in projects attracting the interest of the general public in geomorphology and is also the co-author of '*Petit guide de l'observation du paysage*' which was published last year.